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THE PRESENT CONDITION OF THE NATURAL SCIENCES IN SWEDEN.

BY FILIP TRYBOM.[1]

IN describing the progress of the zoological science in Sweden during the later decades, and that, too, in a country with such resources as the United States, I beg you to remember that though Sweden, the old country in the far north, was happy enough to be among the countries in which, during a comparatively early period, the sciences were cultivated, the number of its inhabitants is less than that of the State of New York alone, and that its wealth, and consequently the money which can be bestowed upon the sciences, always has been limited.

The homes of the study of natural history in Sweden have been and are still the Universities of Upsala and Lund and the Academy of Sciences in Stockholm, created by Linnæus. The predecessors of Linnæus in Upsala, viz., the Rudbecks, father and son, were both eminent zoologists for their time, but the collections they brought together were totally destroyed by fire. Linnæus and his successors, Wahlenberg included, who died in 1851, were at the same time professors of medicine and natural history, thus being obliged to spread themselves over a much too large field of work and study. As to Wahlenberg, he mostly devoted himself to botany during his long-lasting professorship. It was not until three years after his death, or in 1854, that the first professorship entirely devoted to zoology was established at the

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University of Upsala, the first professor being W. Lilljeborg, who is now a professor emeritus, but who, despite his seventy years, still remains very active and industrious. At the University of Lund Professor S. Nilsson and many of his pupils had already been working up different branches of the Swedish fauna during the period previous to and contemporaneous with the above changes in Upsala.

In a very close connection with the Academy of Sciences in Stockholm is our "Riksmuseum" (corresponding to the National Museum in Washington). It belongs to the government, but the academy is its "Board of Regents," elects its curators, or, as they are called, intendents, etc. There are three zoological departments,—one containing the vertebrates, one the insects, and the third all the other invertebrates. Besides, there is one department for palæozoology.

Our Swedish vertebrates had been made comparatively well known and described by S. Nilsson, Sundevall, Lilljeborg, and other zoologists more than twenty or thirty years ago; the insects had been studied during the first half of the century by Gyllenhaal, De Geer, Boheman, Zitterstedt, Dahlborn, and others. Compared with the insects, other classes of the invertebrate animals were considerably neglected; but S. Lovén had written his "Index Molluscorum litora Scandinaviæ accidentalia habitantium;" Düben, together with the Norwegian zoologist Koren, had edited their "Review of Scandinavian Echinoderms," etc. The zoological collections in the "Riksmuseum" were growing fast, and in Lund Professor S. Nilsson had brought together good collections of our vertebrates, but in Upsala the zoological museum belonging to the university was in a bad condition when Lilljeborg was elected a professor. Meanwhile, there were, and are still, some old valuable collections, as the types of Linné's "Museum Ludovicæ Ulricæ," all with his own labels, and of the insects described by Gyllenhaal, etc. The above-mentioned Linnæan types consist mostly of molluscs, echinoderms, fishes, insects, and corals. Professor Lilljeborg, although he had very small appropriations at his disposal, established nearly a new museum of all classes of our Swedish animals during his professorship.

When the Swedish Arctic expeditions were first started new impulses were given to zoological studies and researches. The

leaders, always accompanied by a staff of younger and enthusiastic naturalists, brought home very large zoological collections, and in that way our "Riksmuseum" grew. I believe it now contains the most complete series of Arctic European and Asiatic invertebrates, especially of the marine ones.

S. Lovén was the first to start these expeditions, going, as he did, to Spitzbergen in 1837. Professor O. Torell made four expeditions to Iceland, Spitzbergen, and Greenland, the last one in 1861. The expeditions of Nordenskiold of more recent dates, following the lead of Lovén, are too well known to require any further mention.

As the first expeditions mostly were directed to Spitzbergen, the animal life of that Arctic region, through their efforts, was made thoroughly well known.

A short enumeration of the more important papers written in regard to the collections from there, so far as I now can remember them without going to original sources, may not be out of place in order to show how much these expeditions have contributed to zoological science.

The mammals of Spitzbergen have been described by Quennerstedt, Malmgren, and C. H. Andersen; the birds by Sundevall, Malmgren, and Newton; the fishes by Malmgren; the insects by Boheman and A. E. Holmgren; the spiders by T. Torell; the crustaceans by Goës, G. O. Sars, and Lilljeborg; the molluscs by Lovén and O. Torell; the Bryozoa by F. A. Smitt; the annulates by Malmgren, and some other orders of worms by Goës; the Oligochæta by G. Eisen. The geographical distribution of the animals living in the seas surrounding Spitzbergen has been treated of by Malmgren, Lovén, and Quennerstedt.

As to the zoological results of Nordenskiold's later expeditions to the Arctic Asiatic seas and to Siberia during the years 1875, 1876, and 1878–80, I only may mention that of his companions Stuxberg has worked up the myriapods, the crustaceans, the echinoderms, and the general distribution of animals in those waters, while Théel has reported on the birds, worms, and holothurians; Nordquist, another companion of Nordenskiold, has written up the mammals. Most of the insects which I collected in Siberia, 1876, were described by Professor J. Sahlberg, in Helsingfors, who during the same year travelled in the land of the exiles. The insects collected during the other expedi-

tions have been treated of by Mäklin and Chr. Aurivillius; Collembola by T. Tullberg; spiders by L. Koch, Kramer, and Neuman; molluscs by Leche, Carl, Aurivillins, and Westerlund; worms by Wiren; and Tunicata by Swederus.

In order to investigate the animal life of the seas surrounding our coasts, the government detached a gunboat, and paid the expenses and salaries of the scientists for a series of years, the last being 1879. The zoological exploration of our seas and inland waters, as well as that of our woods and fields, is, furthermore, encouraged by means of yearly contributions of money by the Academy of Sciences in Stockholm and by the universities, this money being the interest of funds donated or willed by private persons or special appropriations by the Diet. As travelling in our country is cheap, and as the expeditions mostly are limited to a few months, the amounts fixed for each party are usually rather small. Larger amounts appropriated for travels for scientific purposes in foreign countries, and the rules and conditions in regard to these, are very different for every one of them. As these usually are the objects of considerable competition, they are distributed alternately between the different sciences. Thus, to mention an example, my present visit to North America, with the object of studying the fisheries of this continent, is due to such a stipend awarded by the Academy of Agriculture, which virtually represents an administrative department of economy. This stipend is disposed of alternately by the academy just mentioned, the Academies of Sciences and Antiquities, and the two old universities.

About ten years ago a Swedish zoologist, Dr. G. Eisen, travelling by means of the same stipend, went to California, whence he sent home his report and the different collections made while remaining there himself. The last zoologist to receive it was Dr. C. Bovallius, who spent it in travels through Centro-America.

The studies of our Swedish salt-water animals have been greatly facilitated of late by the establishment of a permanent station or headquarters for these studies in a locality well suited for the purpose, being, as it is, sheltered by islands in such a way that dredgings can be done almost at any season and weather on different kinds of bottom and in various depths, up to one hundred fathoms, in a bay close to the station. The amount needed for its construction—I believe about thirteen thousand

dollars—was donated by a Swedish physician living in Brazil. The yearly running expenses—being only between five hundred and six hundred dollars—are paid by the government. In the laboratory there are eight working-rooms, with tables, microscopes, and small aquaria, sufficient for about a dozen students; and if there be not zoologists enough to fill these places, botanists, geologists, or hydrographers are admitted. There, for instance, Professor Nathorst (the palæobotanist) made his experiments and investigations in regard to the impressions and tracks formed in the clay by decapods, worms, etc., most of which until recently were supposed to be fossil sea-weeds. A collection of marine animals from the coast province, where the station is situated, is still in progress of formation, but a very good and complete collection of this kind has already for many years been in existence in the zoological department of the Gothenburg Museum.

Up to the seventh decade of this century only a few of our Swedish zoologists were studying comparative anatomy, histology, or embryology; Clason in Upsala, G. Retzius in Stockholm, Lindgren in Lund,—all three professors of anatomy in the medical faculties,—and S. Lovén being nearly the only ones cultivating these branches. Since that time, or at least since T. Tullberg was appointed a professor in Upsala, succeeding Professor Lilljeborg, anatomy has been carried on as the main branch of the zoological studies at that university. The government has made appropriations for the establishment of a special anatomical department with its own teacher, and this department has now an extensive collection of anatomical preparations, partly in alcohol, but mostly consisting of dried objects, as stomachs, guts, hearts, lungs, livers, kidneys, and milts, prepared according to the system of Brunetti, greatly improved by Professor Clason. About one hundred students attend the courses in anatomy and histology in this department every year. The ordinary professor lectures in two different courses, one consisting of the elements of anatomy and osteology, histology, etc., for the young medical students and for those intending to become school-teachers, the other for students intending to graduate with zoology for their main science. The average number of students attending the latter course during the last years has been sixteen. Beginning with the Protozoa, the professor lectures on that group four hours a week during one term of twelve

weeks. Within each of the chief divisions of the animal kingdom he treats separately of its anatomy, histology, and embryology, winding up by giving a review of the morphological classification of the group. Therefore a student, if not having had an opportunity of attending more than one term of the lectures, will nevertheless get a fair idea of the scientific treatment of at least one group in its entirety, and of the present state of our knowledge in regard to it, as well as of how much is still to be studied and investigated; he learns to recognize the common characteristics of the animals composing the group, and to judge of the probable courses its genera and species have followed in being evolved from more generalized types.

After having graduated with the degrees of candidate and licentiate of philosophy, and before becoming doctors, the students have to publish and in an official discussion defend a treatise relating to their special science. As I have the three last zoological dissertations handy, I brought them with me to this meeting as examples. The first one, by Wiren, is about the circulatory and digestive organs of some families of Annulata; the second, by Fristedt, on the Swedish sponges, and the third, by Appelldf, about Japanese cephalopods.

At the recently established high school in Stockholm the study of zoology is carried on nearly on the same plan as in Upsala, but not to the same extent, nor with the same resources. Two young lady students—A. Carlson and C. Westling—at this high school have recently published some anatomical treatises, the only zoological papers ever written by any Swedish lady, as far as I know.

The larger and more important works published by the Swedish zoologists of late years, as, for instance, Lovén's Echinoderms, T. Torell's Spiders, T. Tullberg's Podurids and his histological treatises, H. Théel's "Challenger" Holothurians, Lilljeborg's Swedish Mammals and Fishes, Thomson's Coleoptera, Neuman's Hydrachnids, P. Olson's Entozoa, etc., are more or less known on this side of the Atlantic, so that I need not mention them further. But the great work by Professor G. Retzius on the Morphology and Histology of the Ear of the Vertebrates, the most extensive Swedish zoological publication of recent date, has perhaps failed to reach many of the natural history libraries in this country, because he is a professor at an

exclusively medical institution, and as this work is printed and published at his own expense, and not as a part of any public reports or proceedings. Professor T. A. Smith's book on Salmonides and Coregonides, just issued, may perhaps likewise not yet have been received here.

Before leaving our Swedish zoologists I wish to mention the work that some of them are engaged in at present. Their Nestor, Professor S. Lovén, now seventy-seven years of age, is revising the Echinoderms described by Linnæus. Professor Lilljeborg is publishing his book on the Scandinavian Fishes, and, after having finished that work, he intends to publish a volume on the Entomestraca. Théel is working on the Holothurians collected on board the United States steamer "Blake." C. Bovallius is busy with the Hyperidæ and the parasitic Isopods, C. Aurivillius with the Lepadidæ, F. Fristedt with the Sponges contained in our "Riksmuseum."

FIDDLER-CRABS.

BY J. M'NAIR WRIGHT.

MY most intimate friends at the seaside are the ill-tempered but handsome fiddler-crabs,—Gelasimus of science. I enjoy their beauty and their ability, but am no doubt cordially hated by them for my interference with their domestic affairs. There is an intensity to their action which is seldom met with among the lower inhabitants of the shore. I have watched them by the hour and have never tired. Their holes dot the beach in favored localities, and near each hole is a small heap of sand brought up from below by the industrious digger, whose cellar never seems large enough. I have noticed that there is a correspondence between the noise made in seating one's self near a hole and the length of time that elapses before the worker appears, and that his first appearance is made with extreme caution. There can be no question about his sense of hearing. A rap near the hole keeps him down a long time, conversation in the vicinity has the same effect, and then when he does venture to appear at his door, it is with the most timid air. He protrudes but a portion of his body and then carefully examines his sur-